BP SPILL

Quality Assurance Sampling Plan

May 18, 2010

6067856

TABLE OF CONTENTS

Section **Page**

EXECUTIVE SUMMARY ES-1

1. INTRODUCTION 1-1

1.1 PROJECT OBJECTIVES 1-1

1.2 PROJECT TEAM 1-2

1.3 QASP FORMAT 1-2

2. SITE DESCRIPTION AND BACKGROUND 2-1

3. SAMPLING APPROACH AND PROCEDURES 3-1

3.1 OVERVIEW OF SAMPLING ACTIVITIES 3-1

3.1.1 Data Quality Objectives 3-1

3.1.2 Health and Safety Implementation 3-2

3.2 WATER SAMPLING 3-2

3.2.1 Off-shore Sampling 3-2

3.2.1.1 Offshore Dispersant Area Assessment Locations .... **Error! Bookmark not defined.**

3.2.2 Nearshore Assessment ..... **Error! Bookmark not defined.**

3.2.2.1 Nearshore Monitoring Sample Locations **Error! Bookmark not defined.**

3.2.3 Vessels of Opportunity and Navigation 3-5

3.2.4 Continuous *In Situ* Fluorescence Measurements **Error! Bookmark not defined.**

3.2.5 Water Sample Collection ..... **Error! Bookmark not defined.**

3.2.5.1 Fluorescence Monitoring Samples ..... **Error! Bookmark not defined.**

3.2.5.2 Laboratory Samples ..... **Error! Bookmark not defined.**

3.3 OFF-SHORE AND NEAR-SHORE AIR SAMPLING 3-7

3.4 ON-GOING AIR SAMPLING AND MONITORING **ERROR! BOOKMARK NOT DEFINED.**

3.5 ON-GOING WATER AND SEDIMENT SAMPLING **ERROR! BOOKMARK NOT DEFINED**

3.5.1 Quality Assurance/Quality Control Samples **Error! Bookmark not defined.**

3.6 SAMPLE MANAGEMENT 3-10

3.6.1 Sample Handling Procedures 3-10

3.6.2 Sample Nomenclature 3-11

3.6.3 Sample Container and Equipment Decontamination 3-12

3.7 SAMPLE PRESERVATION AND HOLD TIMES 3-13

4. ANALYTICAL APPROACH 4-1

4.1 ANALYTICAL METHODS 4-1

4.1.1 Chemistry Analytical Methods 4-1

4.1.2 Ecotoxicity Methods 4-2

4.1.2.1 Acute Toxicity ScreeningTests (Standard) 4-2

4.1.2.2 Acute Toxicity Screening Tests (Photo-enhanced) 4-3

4.1.2.3 Sublethal (Chronic) Toxicity Tests 4-3

4.1.2.4 Collection of Samples for PAH analysis 4-13

TABLE OF CONTENTS (CONTINUED)

Section **Page**

4.1.2.5 Evaluation Criteria for Ecotoxicity Assessment 4-13
4.2 DATA VALIDATION 4-14
5. QUALITY ASSURANCE 5-16
5.1 SAMPLE CUSTODY PROCEDURES 5-16
5.1.1 Chain of Custody 5-16
5.1.2 Sample Shipment 5-17
5.2 PROJECT DOCUMENTATION 5-18
5.2.1 Field Documentation 5-19
5.2.2 Report Preparation 5-20
5.2.3 Response Manager 5-21
6. REFERENCES 6-1

LIST OF APPENDICES

Appendix A – Data Quality Objectives

Appendix B – Standard Operating Procedures

Appendix C – Sentinel Monitoring Stations: Latitude and Longitude

Appendix D – EPA Region 6 Air Sampling and Monitoring QASP

Appendix E – EPA Region 4 Air Monitoring QASP

Appendix F – EPA Region 6 Water and Sediment QASP

Appendix G – EPA Region 4 Beach and Sediment QAPP

Appendix H – Water Quality Benchmarks

Appendix I – EPA Hazardous Air Pollutant Screening Levels

LIST OF FIGURES

Figure 1-1 Organization Chart

Figure 3-1 EPA Region 6 Assessment Boundary

Figure 3-2 EPA Region 4 Assessment Boundary

Figure 4-1 Toxicity Test

LIST OF TABLES

Table 1-1 Key Personnel and Responsibilities

Table 4-1 Analytical Methods, Container, Preservation and Holding Times

Table 4-2 Screening Level and Laboratory Reporting Limits for Water

Table 4-3 Screening Level and Laboratory Reporting Limit for Air (TO-17)

Table 4-4 Test Conditions and Measurement Endpoints: A. bahia 96-Hour Acute Toxicity Screen

Table 4-5 Test Conditions and Measurement Endpoints: M. beryllina Acute Toxicity Screen

Table 4-6 Test Conditions and Measurement Endpoints: A. bahia Chronic Toxicity

Table 4-7 Test Conditions and Measurement Endpoints: M. beryllina Chronic Toxicity

Table 4-8 Test Conditions and Measurement Endpoints: A. punctulata

EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) plans to conduct water, sediment, and air sampling and monitoring for the BP Spill along the Gulf Coast, including off the coast of Louisiana, Mississippi, Alabama, Florida, and Texas. Because of the potential size of and nature of the BP Spill and the response, EPA is concerned that the crude oil, dispersant application, and response technologies may have negative short- and/or long-term impacts on public health and the aquatic environment in shoreline, near-shore, and far off-shore locations. In order to monitor the public health and environmental impacts of this spill, EPA has developed this Quality Assurance Sampling Plan (QASP) to assess the chemical contamination and toxicity to water, sediments, and air as a result of the BP Spill.

METHODLOGY OVERVIEW

The objective of this sampling plan is to provide assessment of the chemical contamination and the toxicity to water, sediments, and air resulting from the spill and response. The plan provides for air, water, and sediment sampling from three general positions relative to the Gulf shoreline: shoreline, near-shore, and far off-shore sampling. At all locations, sampling will be conducted for traditionally-monitored environmental parameters and pollutants, along with chemical constituents of dispersant compounds and crude oil. In addition, water and sediment samples will also be collected for ecotoxicity assesments. Rapid detection methods will be used to identify areas where immediate actions need to be taken to protect public health, and targeted sampling of obviously impacted waters will be performed to inform chemical analytical methods development.

Methods to be employed in this program include: (a) visual monitoring from shore and from ships nearshore and far off-shore to locate obviously impacted waters, (b) fluorescence monitoring to identify oil impacted waters, (c) periodic sampling and laboratory analyses of water and sediments for chemical and toxicological parameters, (d) automated continuous and semi-continuous monitoring of air, (e) periodic sampling and laboratory analysis of air, and (f) mobile monitoring of air quality with TAGA and ASPECT assets.

SUMMARY OF EARLY RESPONSE ACTIVITIES

EPA has been conducting air sampling of particulate matter (PM2.5) as well as VOCs at air sampling locations along the Gulf Coast. Air sampling equipment include BGI PQ200 air samplers, used to collect air samples for PM2.5 and SUMMA® canisters with a 12-hour flow controller collecting ambient air for VOC analysis. Tedlar bags are being utilized to collect grab samples for VOC analysis as necessary.

Additionally, air monitoring activities include the use of DataRAM DR-4000 instrumentation to monitor the particulate levels, AreaRAE PGM-5020 to collect readings for VOCs and MultiRAE instrumentation to monitor for H2S and CO. EPA has also utilized the TAGA Mobile Laboratory that provides mobile monitoring for the selected compounds of interest (i.e., benzene, toluene, ethylbenzene, and xylenes).

EPA has also been assessing water and sediment quality along the Gulf Coast. Multiple project teams have been deployed to multiple locations collecting surface water and sediment samples and collecting real-time water data utilizing multi-parameter water quality instruments. Additional sampling, to determine the presence of free oil globules and/or surface oil at near shore surface water locations (i.e., within 100 feet of the shoreline), was conducted to characterize the oil and dispersant mixture that is reaching the shoreline. Further sampling along beaches, marshes, tidal flats, or other shoreline types was conducted to collect samples of fresh oil, mousse, tar, tarballs, tar patties that had accumulated as part of the oil release. Samples are being analyzed for VOCs, semivolatile organic chemicals (SVOCs), metals (including mercury), TPH, oil and grease, toxicity in sediments, and total organic carbon.

1. INTRODUCTION

The U.S. Environmental Protection Agency (EPA) plans to conduct water, sediment, and air sampling, analysis, and monitoring to examine the effects of the BP Spill along the U.S. Gulf Coast, including off the coasts of Louisiana, Mississippi, Alabama, Florida, and Texas. Although impacts are closest to U.S. waters, the Agency also recognizes the potential impacts on international waters and the waters of other countries, and is preparing to respond to those possibilities as well. Proposed monitoring locations are shown in Figures 3-1 and 3-2, which are focused at this time on areas from the Louisiana/Texas boundary to the Florida panhandle. Expansion to coastal areas of Texas and the west coast of Florida will occur as needed and in anticipation to spill migration. This Quality Assurance Sampling Plan (QASP) was prepared by EPA Regions 6 & 4 in coordination with headquarters personnel, regional water quality divisions, regional air programs, and environmental response team (ERT) personnel. This plan describes the technical scope of work to be completed as part of this emergency response.

EPA is concerned with the potential impact of dispersant chemicals and crude oil on public health and on shore-line and near shore aquatic environments. Because of the potentially long-term nature of the spill impacts and the ongoing response, a robust study of the public health and environmental impacts of the spill and response is needed.

1.1 PROJECT OBJECTIVES

The objective of this sampling plan is to provide assessment of the chemical contamination and the toxicity to water, sediments, and air resulting from the spill and response. The plan provides for air, water, and sediment sampling from three general positions relative to the Gulf shoreline: shoreline, near-shore, and far off-shore sampling. At all locations, sampling will be conducted for traditionally-monitored environmental parameters and pollutants, along with chemical constituents of dispersant compounds and crude oil. In addition, water and sediment samples will also be collected for ecotoxicity assessments. Rapid detection methods will be used to identify areas where immediate actions need to be taken to protect public health, and targeted sampling of obviously impacted waters will be performed to inform chemical analytical methods development.

Shoreline air sampling from multiple platforms is already being conducted as part of the early emergency response (Appendices D & E). Additionally, surface water and sediment sampling activities are also being performed (Appendices F & G). These activities will now be integrated into a comprehensive Gulf-wide ecological assessment. In addition, the sampling and analysis described in this plan is complemented by the air, water, and sediment sampling, analysis, and monitoring activities that normally occur under state and federal programs in Gulf states.

This document summarizes the methods that will be used for the sampling, analysis, and monitoring. In addition, the frequency of these activities and maps of their likely locations are provided.

1.2 PROJECT TEAM

The Project Team will consist of the necessary EPA and EPA contractor personnel to implement the monitoring and sampling strategies described herein. The project team will consist of a site lead(s) and the necessary number of operational person to implement the approach included herein. In addition, EPA and EPA contractor personnel will be assigned as necessary to facilitate successful implementation. Figure 1-1 illustrates the currently proposed organization chart.

EPA and potentially ERT members will also be on-site to assist with coordination and on-site direction of sampling, data collection, and analysis as needed. EPA will coordinate with the Unified Command as necessary.

1.3 QASP FORMAT

This QASP has been organized in a format that is intended to facilitate and effectively meet the objectives of this Emergency Response. The QASP is organized as follows:

- Section 1 – Introduction
- Section 2 – Site Description and Background
- Section 3 – Sampling Approach and Procedures
- Section 4 – Analytical Approach
- Section 5 – Quality Assurance
- Section 6 – References

Figures referred to in this document are presented as separate portable document format (PDF) files. Tables are presented at the end of each respective section.

Table 1-1

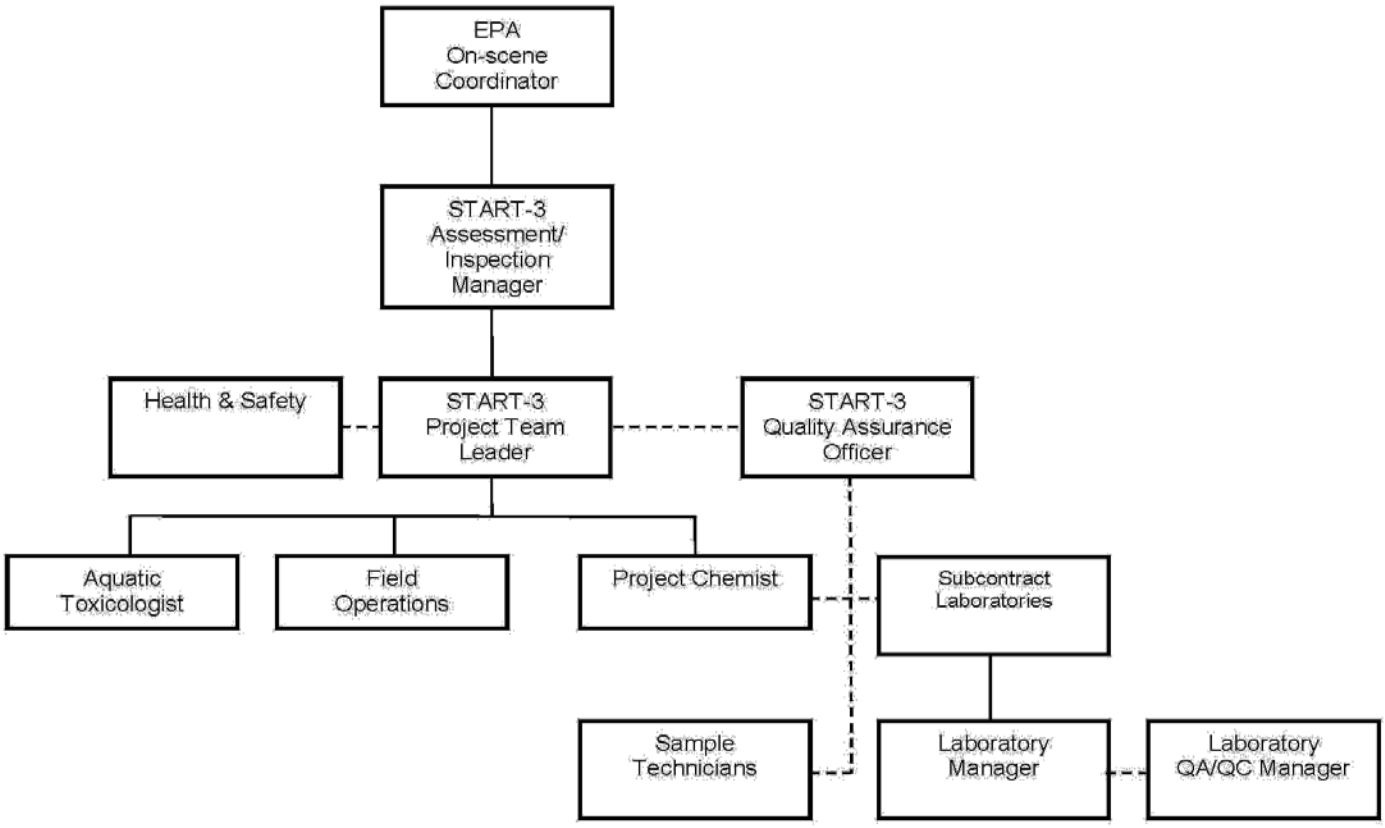
Key Personnel and Responsibilities

BP Spill
Louisiana/Mississippi /Alabama/Florida/Texas Coast

ORGANIZATION	NAME (TITLE)	RESPONSIBILITIES
EPA Personnel	Paige Delgado (R6) John Martin (R6) Jon Rauscher (R6) Don Williams (R6) Rich Mayer (R6) Rick Ehrhart (R6) Dr. Phillip Turner (R6) Maria Martinez (R6) Mike Schaub (R6) Glenn Adams (R4) Brett Thomas (R4) Sharon Thomas (R4)	Primary Contact for the project and responsible for all activities performed for the project, including management of EPA contractors.
EPA Contractors	Assessment/Inspection Manager	Responsible for all activities performed by EPA contractors including coordinating project activities with the EPA contractors Project Team Leader (PTL), preparing reviewing reports and correspondence submitted to EPA, and attending project meetings.
	Project Team Leader	Responsible for directing activities performed by EPA contractors and assumes total control over project activities. Specific responsibilities include communicating with the EPA, coordinating activities with appropriate support personnel, implementing health and safety criteria, preparing and reviewing reports and correspondence submitted to EPA, and attending project meetings.
	Quality Assurance Officer	Responsible for reviewing project plans, submittals, and documents produced by EPA contractors. Specifically, she will ensure EPA contractors submittals, plans, and documents comply with industry and EPA contractors standards; conduct audits; and prepare corrective action memorandums. The QAO is responsible for making sure project personnel have initial QASP training and follow-up training as needed.
	Aquatic Toxicologist	Responsible for development and implementation of aquatic toxicology and environmental risk assessment support, coordination and maintenance of close

		communication with EPA Risk Assessors.

Figure 1-1
Organization Chart



2. SITE DESCRIPTION AND BACKGROUND

The BP Spill source is located approximately 52 miles southeast of Venice, Plaquemines Parish, Louisiana, (28.73667˚ N, -88.38722˚ W). The source is a leaking production well caused by damage from the sinking of the Transocean Deepwater Horizon drill rig at BP Site Mississippi Canyon 252. The size of the impacted area resulting from the release varies from day-to-day, but is presently several hundred square miles in size. The spill is affected by wind and wave action, which continues to impact the size, shape, and movement of the oil. The known or potential impact zone includes the shorelines of Louisiana, Mississippi, Alabama, Florida, and Texas. Impacts to international waters and the territorial waters of Mexico, Cuba, and other countries are also possible.

3. SAMPLING APPROACH AND PROCEDURES

The sampling approach that will be applied to BP Spill is discussed in this section. In general, the sampling plan consists of the following activities:

- Water Sampling, Analysis, and Monitoring
  - Shoreline
  - Nearshore
  - Far Off-Shore
- Air Sampling, Analysis, and Monitoring
  - Shoreline
  - Nearshore
  - Far Off-Shore
- Sediment Sampling, Analysis, and Monitoring
  - Shoreline
  - Nearshore
  - Far Off-Shore

Sampling methods, locations, quality assurance (QA) procedures, and the analytical approach that will be used are discussed in the following sections. This plan may be increased or modified as necessary to address areas beyond those identified herein.

3.1 OVERVIEW OF SAMPLING ACTIVITIES

EPA contractors will assist EPA with coordination and on-site direction of sampling as outlined herein.

3.1.1 Data Quality Objectives

Data Quality Objectives (DQOs) will be established prior to implementation of this sampling plan. They will be developed using the seven-step process set out in the *EPA Guidance for Quality Assurance Project Plans:* EPA QA/G-5. The water,air, and sediment DQOs established for this project are included in Appendix A.

.

3.1.2 Health and Safety Implementation

Maintaining and assuring the health and safety of all EPA personnel is the top priority of this sampling effort. EPA will provide planning functions consistent with activities and responsibilities of the Incident Command System (ICS). At the beginning of each operational period, a daily operation meeting will be held in the command post to discuss objectives of the operational period, division assignments, field instrumentation calibration and use, and health and safety protocol.

EPA sampling activities will be conducted in accordance with the site-specific Health and Safety Plan (HASP). EPA will conduct the sampling activities in Level D personal protective equipment (PPE), with the potential to upgrade PPE as necessary, and as stated in the site HASP. The Field Team Leader (FTL) or designated Field Safety Office (FSO) will be responsible for implementation of the HASP during the sampling activities.

EPA personnel will be instructed to communicate unsafe situations immediately to supervisors and co-workers, and to immediately take appropriate measures. Sampling activities will be stopped whenever necessary to assure the safety of all engaged personnel.

3.2 WATER SAMPLING

Water sampling activities will be conducted in accordance with the EPA guidelines, standard industry practices; and with EPA ERT and Regional START Standard Operating Procedures (SOPs). The site-specific sampling activities are described in the following subsections. For reference, SOPs supporting this QASP are included in the Appendices.

3.2.1 Locations

Water samples will be collected at shorelines, nearshore in waters within 3 miles of shore, and far off-shore at distances between 3 and 50 miles.

Shoreline sampling locations were pre-determined using Visual Sampling Program (VSP) software. VSP is a software tool that supports the development of a defensible sampling plan based on statistical sampling theory and the statistical analysis of sample results to support confident decision making. VSP randomly identified the location of the sample stations using a

one-sample proportion test for 95% confidence level. Approximately 96 sample stations are located along the Gulf Coast from Louisiana to the Florida panhandle: 50 are located within EPA Region 4 and 46 are located within EPA Region 6. Figures 3-1 and 3-2 illustrate the locations of these stations. Information regarding station identification and geographic position (latitude, longitude in decimal degrees) in included in the Appendices. Water quality samples for chemistry and toxicity testing will be collected at each location.

Nearshore and far offshore sampling locations for also pre-determined using a similar process with the Visual Sampling Program (VSP) software. A total of 70 nearshore sample stations are located along the 3 mile limit: 35 are located within EPA Region 4 and 35 are located within EPA Region 6. Figures 3-3 and 3-4 illustrate the locations of these stations. Information regarding station identification and geographic position (latitude, longitude in decimal degrees) in included in Appendix C.

A total of 70 far offshore sample locations are located at distances of 10 miles from the shoreline, and at 10 mile intervals up to 50 miles perpendicular from the shoreline angled towards the center of the Gulf, starting at approximately every 5th nearshore monitoring location. Those off-shore sample locations closest to the spill site will be performed to avoid transits which would take sampling boats into areas with thick crude and those areas under active operations by emergency response operations vessels. Water quality samples for chemistry and toxicity testing will be collected at each location.

Survey or navigation software (e.g., Hypack by Coastal Oceanographics or similar) is recommended to aid the vessel operator in maneuvering along the 3 mile limit in a systematic fashion. Parallel transect lines (500 m spacing) trending along the 3 mile limit shall be pre-determined prior to sampling.

3.2.2 Sampling

For each sample location, the following sampling/survey procedure shall be followed:

1. Visual observation to identify locations of obviously impacted waters, with sampling of these waters for analytical methods development.

2. Collection of water samples for fluorometric analysis for oil using the field fluorometer.
3. Collection of water samples for chemical and toxicological analyses.
4. Use of rapid detection methods for potential immediate public health notifications.

Laboratory analyses will be performed on triplicate samples collected via approved EPA methodology, with chain of custody, and shipped to an approved laboratory. For nearshore and far off-shore sampling, six samples from each station will be collected. Three samples will be collected at 2 m depth, and three at 10 m depth.

Solar radiation monitoring of spectral wavelength and intensity will be conducted at each station with a radiometer (e.g. International Light, Inc. Underwater Radiometer Detector, or similar) when samples for laboratory analyses are collected. These data will be used to groundtruth the ecotoxicity tests under photo-enhanced conditions.

As a result of the BP Spill, EPA has already been assessing water and sediment quality along the Gulf Coast. These efforts will be integrated into the comprehensive plan described in this document. Multiple project teams have been deployed to multiple locations based upon site conditions and operations. As the meteorological and operational situations change, sampling and monitoring teams and operations have adapted, based upon direction from the Unified Command. EPA has been collecting surface water and sediment samples and collecting real-time water data utilizing multi-parameter water quality instruments. Additional sampling, to determine the presence of free oil globules and/or surface oil at near shore surface water locations (i.e., within 100 feet of the shoreline), was conducted to characterize the oil and dispersant mixture that is reaching the shoreline. Further sampling along beaches, marshes, tidal flats, or other shoreline types was conducted to collect samples of fresh oil, mousse, tar, tarballs, tar patties that had accumulated as part of the oil release. Samples are being analyzed for VOCs, SVOCs, metals (including mercury), TPH, oil and grease, Toxicity in Sediments, and total organic carbon. Field parameters include the collection of pH, conductivity, dissolved oxygen and turbidity.

Details regarding protocols and procedures for previous surface water and sediment sampling are included as Appendices F & G.

3.2.3 Chemical and Toxicological Analysis of Water Samples

Chemical, toxicological, and fluorometric analysis of water samples will be performed as described by the field and laboratory methods in Chapter 4.

3.2.4 Vessels for Near and Far Off-Shore Sampling

3.2.4.1 ***EPA OW Gulf of Mexico Office and Stennis Space Center***

Multiple sources of ships are available to EPA and EPA contractors to perform the near-shore and far off-shore sampling described in this plan. For convenience and efficiency, every opportunity to use EPA or EPA-affiliated vessels will be taken. This includes the use of the marine assets and staging infrastructure available at the EPA Gulf of Mexico Program Office at the Stennis Space Center in Mississippi. Vessels available for near-shore sampling include three (3) 21-25’ open center consoles vessels with room for equipment and up to 3 sampling personnel plus the captain. Gulf Program office staff will coordinate procurement and billing charges through Regions 4 and 6.

Through contacts at the Gulf Program, EPA and EPA contractors have access to the use of a 43' turbine powered marine patrol vessel, owned and operated by the Mississippi Department of Marine Resources (Exec. Director Dr. Bill Walker).

Additionally, one of the Gulf Program Director’s staff has a 4 seat high wing airplane (Cesna 172) hangered at the Stennis Space Center. This asset, and the pilot, are readily available to fly air reconnaissance and radio gps coordinates of desired sampling sites (i.e., sheen, dense crude, orange colored surface deposits, etc.) to sampling crews to help eliminate inaccurate chance navigation to strategic sampling plan events.

3.2.4.2 ***University-National Oceanographic Laboratory System (UNOLS)***

University-National Oceanographic Laboratory System (UNOLS) is an organization of 61 U.S. academic institutions and National Laboratories involved in oceanographic research and joined for the purpose of coordinating oceanographic ships' schedules and research facilities. Two participating institutions, the Louisiana Universities Marine Consortium and the University of Miami, have vessels of approximately 100 ft. length that could be contracted for sampling in far off-shore locations. The eight participating universities along the gulf have additional smaller boats that could be leased for near-shore sampling programs.

3.2.4.3 ***RV Bold***

[insert text about capability and availabilty of RV Bold for far off-shore sampling]

3.2.4.4 ***Other EPA-Leased Vessels***

Additional water quality surveys and sampling will be conducted from vessels acquired through standard leasing arrangement. There are no specific requirements for each vessel other than each vessel must be: 1) operated by a Unites States Coast Guard [USCG] licensed captain; 2) provisioned with properly maintained safety equipment; and 3) equipped with GPS instruments capable of continuously recording vessel position. Each vessel should have adequate deck space for the safe deployment, retrieval and operation of water samplers, as well as for storage of water samples. The vessel’s GPS should be capable of receiving differential corrections from the USCG or Wide Area Augmentation System (WAAS) corrections from the Federal Aviation Administration (FAA).

3.3 AIR SAMPLING

3.3.1 Sampling for Crude Oil and Dispersant Chemical Constituents

This sampling scheme has been designed to assess the potential impacts to air quality and possible human and ecological airborne exposure to the chemical constituents of crude oil and dispersant chemicals. Crude oil is a complex mix of numerous hydrocarbons and metals, some of which are volatile, semi-volatile, or can become airborne as aerosol constituents during normal wind and wave activity. Several dispersant formulations are currently being used to respond to the BP Spill. Some dispersants are known to contain polypropylene glycol and a propriety organic sulfonic acid salt. These two materials are common emulsifying components, and have very low vapor pressure.. In addition to these materials, the dispersants are known to contain organic solvents. These might include light petroleum distillates [CAS 64742-47-8] similar to common kerosene, as well as, 2-butoxyethanol, a common industrial solvent. Since sampling will occur on-land, and on board marine vessels a common and straightforward sampling approach is desirable. Methodology consistent with the shoreline sampling programs that have been implemented during the early weeks of the emergency response (see Appendix D & E) would be beneficial for comparison of results collected over time. EPA Methods TO-15 and TO-17 were selected due to their applicability on board a marine vessel and the ability to acquire a short term grab sample with detection limits low enough to meet many public health risk thresholds.

Although many of the constituents in hydrotreated light petroleum distillates, or 2-butoxyethanol, are not on the calibrated TO-15 compound list, it is believed that quantitative data can be obtained without extensive method development. Many hydrocarbons are well suited to this analytical method and many are not on the calibrated list simply because most of the aliphatic hydrocarbons in petroleum are not classified as Hazardous Air Pollutants (HAPS). While 2-butoxyethanol may not exhibit as high a recovery level as some of the low molecular weight solvents on the TO-15 list, it is sufficiently volatile and much more stable than some compounds that are on the list, such as acrolein. TO-15 is currently being used at land based sample locations, and data comparability with these sites is desired.

EPA Method TO-17, which utilizes sorbent tubes, can provide results for semi-volatile and aerosolized hydrocarbons that may exhibit poor recovery from SUMMA canisters using EPA Method TO-15. Appropriate sorbent tubes are available for the light petroleum distillates, propylene glycol, and 2-butoxyethanol. Laboratory experience indicates a one liter sample at 100 mL/min can achieve detection limits of about 200 parts per billion (ppb) for the petroleum distillates, 160 ppb for the propylene glycol and 10 ppb for the 2-butoxyethanol.

Samples will be collected using equipment and procedures appropriate to TO-15 and TO-17, as applicable. Short term TO-15 grab samples will be collected in SUMMA canisters over two to three minutes time using a laboratory supplied filter and vacuum gauge to monitor the sampling rate. Samples should be collected such that 2 to 3 inches mercury vacuum remains after sample collection. Samples will be collected upwind of the sampling vessel engine exhaust and any other obvious sources of non-dispersant or spill related VOCs.

TO-17 samples will be collected using laboratory supplied sampling tubes and SKC (or equivalent) low flow sampling pumps set to 100 mL/min flow rate for a period of 10 minutes. Sample flow rates will be measured before and after each sample collection event using a BIOS DryCal or Buck Scientific primary standard flow calibrator. Samples will be collected upwind of vessel exhaust and other obvious sources not related to the spill or dispersant application. Following collection, samples will be assembled and catalogued prior to shipping to the designated laboratory.

3.3.2 Criteria Pollutant and Air Toxics Air Sampling and Monitoring from Temporary Locations

Due to the BP Spill, EPA Region 4 and 6 have been conducting air sampling of particulate matter (PM2.5) as well as VOCs at air sampling locations along the Gulf Coast. Air sampling equipment include BGI PQ200 air samplers, used to collect air samples for PM2.5 and SUMMA® canisters with an 8-hour flow controller collecting ambient air for VOC analysis. Tedlar bags are being utilized to collect grab samples for VOC analysis as necessary.

Additionally, air monitoring activities at each site will include DataRAM DR-4000 instrumentation to monitor the particulate levels, AreaRAE PGM-5020 to collect readings for

VOCs using a 10.6 electron volt (eV) photoionization detector (PID) lamp, and MultiRAE instrumentation to monitor for H2S and CO using chemical specific electrochemical sensors.

[insert a more complete description of air monitoring being conducted along Gulf]

3.3.3 Criteria Pollutant and Air Toxics Air Sampling and Monitoring from Permanent Locations

[insert text about existing criteria pollutant, meteorological, and air toxics networks (AirNow) along Gulf]

[describe enhancements (increase in frequency) being stood-up because of spill)

{insert map showing all locations of air monitoring in LA, MS, AL, FL panhandle]

3.3.4 TAGA and ASPECT Air Monitoring

EPA has also utilized the TAGA Mobile Laboratory that provides mobile monitoring for the selected air toxic compounds of interest (i.e., benzene, toluene, ethylbenzene and xylenes), along with compounds of interest from dispersants.

Details regarding protocols and procedures for on-going air sampling and monitoring for TAGA and ASPECT assets are included in the Appendicies.

3.4 SEDIMENT SAMPLING

3.4.1 Locations

3.4.2 Sampling

3.4.3 Chemical and Toxicological Analysis of Sediment Samples

3.4.4 Vessels for Near Shore Sediment Collection

[need text from R4/R6/ORD/OW on sediment sampling description, and get details into Appendices]

3.5 WATER SAMPLE MANAGEMENT

Sample handling, nomenclature and container/equipment decontamination procedures are discussed in the following subsections.

3.5.1 Water Sample Handling Procedures

Water samples will be collected using equipment and procedures appropriate to the matrix, parameters, and sampling objectives. The volume of the sample collected will be sufficient to perform the analysis requested. Samples will be stored in the proper types of containers and preserved in a manner for the analysis to be performed per laboratory guidelines. Personnel responsible for sampling will change gloves between each sample collection/handling activity.

The sample containers will be handled using gloves appropriate for the hazards involved with handling of petroleum spill related samples (e.g. nitrile). The gloves serve two purposes, 1) personnel protection and 2) prevention of sample cross-contamination. The gloves shall be replaced at a minimum between each sample collected or as frequently as needed.

Air samples will be collected using equipment and procedures appropriate to TO-15 and TO-17 as applicable, and these sampling objectives. Short term TO-15 grab samples will be collected in SUMMA canisters over two to three minutes time using a laboratory supplied filter and vacuum gauge to monitor the sampling rate. Samples should be collected such that 2 to 3 inches of mercury vacuum remains after sample collection. Samples will be collected upwind of the sampling vessel engine exhaust and any other obvious sources of non-dispersant or spill related VOCs.

TO-17 samples will be collected using laboratory supplied sampling tubes and SKC (or equivalent) low flow sampling pumps set to 100 mL/min flow rate for a period of 10 minutes. Sample flow rates will be measured before and after each sample collection event using a BIOS DryCal or Buck Scientific primary standard flow calibrator. Samples will be collected upwind of vessel exhaust and other obvious sources not related to the spill or dispersant application. Following collection, samples will be assembled and catalogued prior to shipping to the designated laboratory.

3.5.2 Quality Assurance/Quality Control Samples

EPA contractors will collect blind field duplicate/triplicate samples of water and equipment rinsate blanks during the sampling effort. Quality assurance/quality control (QA/QC) samples will be collected according to the following:

- Blind field duplicate samples will be collected during sampling activities at locations selected by the EPA. The data obtained from these samples will be used to assist in the quality assurance of the sampling procedures and laboratory analytical data by allowing an evaluation of reproducibility of results. Blind field duplicate samples will be collected at the rate of one duplicate sample for every 10 samples collected or as directed by the EPA.
- Equipment rinsate blanks will be prepared by pouring laboratory grade deionized water over nondisposable sampling equipment after it has been decontaminated and collecting the rinse water in sample containers for analyses. These samples will be prepared to demonstrate that the equipment decontamination procedures for the sampling equipment were performed effectively. The equipment rinsate blanks will be prepared each day that nondisposable sampling equipment is used or as directed by the EPA.
- Sequential replicates are samples that are collected consecutively instead of simultaneously. Sequential replicates are used to assess variability among samples resulting from collection, processing, shipping, and laboratory procedures conducted at different sampling times. The sequential replicate can be designed to assess sample variability from inhomogeneities in the system being sampled by spacing samples over short or long periods. If needed, the collection of sequential replicates will be approved by the EPA.
- Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected as part of laboratory requirements during sampling activities at locations selected by the field personnel. The data obtained from these samples will be used to assist in the quality assurance of the sampling procedures and laboratory analytical data by allowing an evaluation of reproducibility of results. Efforts will be made to collect MS/MSD samples in locations where there is visual evidence of contamination or where contamination is suspected. The collection of MS/MSD samples will be approved by the EPA.
- Temperature blanks will be prepared in the field and will consist of one 40-milliliter glass sample container with Teflon-lined septum cap. The temperature blank will be packaged along with the field samples in the shipping cooler and will represent the temperature of the incoming cooler upon receipt at the laboratory. Use of these samples within a shipping container enables the laboratory to assess the temperature of the shipment without disturbing any of the field samples.

The EPA and EPA contractors will be responsible for QA/QC of the field investigation activities. Laboratories utilized during the field activities will be responsible for QA/QC related to the analytical procedures.

3.5.3 Sample Nomenclature

Sample identification involves the assignment of sample location numbers and sample depth indicators to all samples collected during the sampling activity. The EPA will specify the sample location number and depth of the samples in the field. Sampling personnel will record this information using a permanent marker on a label applied to the side of the container.

For the purposes of the activity, each sample will receive an individual identification number consisting of a four-digit number (ex. SW01). This four-digit number will be followed by a two digit number which will be used to identify the sample depth as follows: 1 meter below surface (01), 10 meters below surface (10). A QC Code for the type of sample is added to designate a sample as normal (11), duplicate (12), or rinsate (43).

An example, Sample ID is: SW01-01-11. This number corresponds to a normal subsurface water sample collected at a depth of 1 meter below surface from location SW01.

Blind field duplicate samples will be identified in the same manner as the sample locations and will also follow in sequential order. These samples will be given a unique sample number so as not to be obvious to the laboratory.

3.5.4 Sample Container and Equipment Decontamination

Each sample will be collected with clean decontaminated equipment. Equipment decontamination will be required to prevent contamination of clean areas and cross-contamination of samples and to maintain the health and safety of field personnel. Decontamination of all sampling equipment will occur prior to sampling and between each sample location. Decontaminated sampling equipment and sample containers will be maintained in a clean, segregated area. Appropriate equipment decontamination procedures for field sampling equipment will be followed according to applicable EPA, EPA ERT and EPA contractors SOPs.

Equipment decontamination will be completed in the following steps:

- Methanol rinse with soft scrub brush to remove initial oil residue
- Tap water and Alconox rinse with soft scrub brush
- Deionized water rinse, three times
- Methanol rinse

Personnel decontamination procedures will be described in the site-specific HASP that will be prepared by EPA contractors and reviewed by the EPA prior to implementation of activities at the site.

3.6 SAMPLE PRESERVATION AND HOLD TIMES

EPA and EPA contractors will obtain and use precleaned sample containers for water samples collected during the sampling effort. The sample containers will be certified clean, and documentation of this will be required with each bottle lot. Laboratory samples will be stored in coolers with ice until they are submitted for analysis.

Once collected, SUMMA canister air samples will be stored in their shipping boxes. TO-17 samples will be sealed and placed in individual storage vials supplied by the laboratory. TO-17 sorbant tube sample will be maintained at 4° C at all times after sample collection. The maximum holding time for TO-15 is 30 days from sample collection, and the maximum holding time for TO-17 is 28 days from sample collection. For this project, accelerated turn-around-times will be used and it is expected that the method specified holding time will not be an issue. Samples will be shipped to the designated laboratory by an express courier. TO-17 sorbent tube samples and SUMMA canisters will be analyzed by a laboratory selected by the EPA.

EPA will request 24-hour turnaround time for water analytical results unless otherwise advised based on discussions with the laboratory. Turnaround time is initiated when the samples are received at the laboratory and continues until the analytical results are made available to EPA. EPA and EPA contractors will also ensure that the maximum hold time, initiated when the samples are collected in the field, and continues until the samples are analyzed, are not exceeded. Samples that have been analyzed will be disposed by the designated laboratory in accordance with the laboratory SOPs.

4. ANALYTICAL APPROACH

Information regarding analytical methods and data validation procedures is discussed in the following sections.

4.1 ANALYTICAL METHODS

After samples are received by the laboratory, samples will be prepared and analyzed in accordance with the EPA SW-846 or appropriate methods. Laboratory turnaround time for samples is 24 hours from receipt of samples by the laboratory.

Deliverables will include preliminary data via email in pdf format and an EDD in excel format.

Continuous measurements of in situ fluorescence will be conducted to identify the concentrations of polycyclic aromatic hydrocarbons, toxic compounds which are also markers for the presence of crude oil.

4.1.1 Chemistry Analytical Methods

Information regarding analytical methods, sample containers, preservation and hold times is included in Table 4-1. Table 4-2 includes screening levels and laboratory reporting limits for water. The following are potential analytical laboratories for the water and air sampling:

WATER SAMPLES:

Houston Laboratory
6310 Rothway Street
Houston, Texas 77040
713.690.4444
Contact: Lab Manager

EPA Water Quality Benchmarks are included in Appendix H.

AIR SAMPLES:

SUMMA canisters will be analyzed by one of the following subcontract laboratories:

Air Toxics – TO-15 for VOCs
180 Blue Ravine Road, Suite B
Folsom, California 95630
Tel: 1.800.985.5955
Contact: Karen Lopez

SPL, Inc. Laboratory – TO-15 for VOCs
8880 Interchange Drive
Houston, TX 77054-2512
(713) 660-0901
Contact: Lab Manager

Sorbant tube samples will be analyzed for TO-17 by Air Toxics Limited of Folsum, California. Screening levels and laboratory reporting limits are included in Table 4-3. Hazardous Air Pollutant (HAPs) Screening Levels are included in Appendix I.

4.1.2 Ecotoxicity Methods

Ecotoxicity will be assessed using a two-phase approach: 1) rapid acute toxicity screening and 2) sublethal tests for those samples resulting in significantly reduced survival relative to control levels. Acute and short term sublethal test will be conducted concurrently. If acute toxicity is observed in the screening test, then the concurrent short term sublethal test will be terminated for those samples. Each test will have a control (dilution water; see test manual), and reference sample collected from non-impacted areas (i.e., an area that appears free from visible oil contamination or detectable oil related constituents). The evaluation criteria for the ecotoxicity analyses are shown in the Figure 4-1.

4.1.2.1 Acute Toxicity ScreeningTests (Standard)

Acute (96-hour) toxicity screening tests will be performed to determine if 100% water samples cause mortality to aquatic organisms. Tests will be performed on the inland silverside fish, *Menidia beryllina*, and the mysid shrimp, *Americamysis bahia*, in accordance with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (EPA 2002). A summary of test conditions and measurement endpoints proposed for the acute tests are presented in Tables 4-4 (*A. bahia*) and 4-5 (*M. beryllina*). Each batch of test

organisms will be evaluated in reference toxicant tests and results will be compared with historical control charts to establish test organism sensitivity.

4.1.2.2 Acute Toxicity Screening Tests (Photo-enhanced)

Oil in the water column can be 10 times to greater than 100 times more toxic in the presence of natural sunlight. Photo-enhanced toxicity assessment will be used to assess the enhanced toxicity of simulated solar radiation using organisms exposed in the standard toxicity assays above.

Assessment of photo-enhanced toxicity is critical to a complete assessment of the potential impacts of the spill on aquatic life. Many waters of the Gulf are clear, allowing sunlight to penetrate and potentially enhance the toxicity of bioaccumulated oil. Photo-enhanced acute toxicity tests (i.e., conducted under full spectrum lights) will be performed concurrently with the standard acute screening tests (i.e., conducted under normal laboratory lighting) using the same test methods (Tables 4-1 and 4-2) and batch of test organisms but in separate test facilities. Measurements of both light wavelength and intensity will be collected using a broad wavelength radiometer (e.g., International Light Model IL1400BL or similar device). Light intensity will be measured by placing the detector at the bottom of surrogate test containers filled with reference water. Surrogate containers will be placed at multiple locations within the test facility and measurements will be made at both test initiation and termination. Similar measurements of wavelength and intensity will also be collected at select sampling locations in the field to facilitate the risk assessment (see section 3.2.5.2).

4.1.2.3 Short-term Chronic Toxicity Tests

Short term chronic toxicity tests will be conducted to provide an assessment of water column toxicity. Short-term chronic toxicity assays will be performed on the inland silverside fish, *Menidia beryllina*, the mysid shrimp, *Americamysis bahia*, and the sea urchin, *Arbacia punctulata*. Test procedures will be performed in accordance with Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA 2002), ASTM Method E 1563-98 (2004), and Short-term Methods for Estimating the Short-term Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms (1995). A summary of test conditions and measurement

endpoints proposed for the short-term chronic tests are presented in Tables 4-6 (*A. bahia*), 4-7 (*M. beryllina*) and 4-8 (*A. punctulata*). Each batch of test organisms will be evaluated in reference toxicant tests and results will be compared with historical control charts to establish test organism sensitivity.

Table 4-1
Analytical Methods, Container, Preservation and Holding Times

BP Spill, Gulf Coast

Name	Analytical Methods	Matrix	Container	Preservation	Minimum Volume or Weight	Maximum Holding Time
SVOCs	SW846 8270C	Water	Amber Glass, (Teflon- lined for water)	4°C	2 x 1 L	7 days extract (water), 40 days analysis
COD	Standard Methods 410.3	Water	Glass	H2SO4, 4°C	50 mL	28 days
BOD	Standard Method 5210 B (5-day BOD Test)	Water	Glass	4°C	1 L	48 hours
DO, membrane probe[1] (or Winkler method)	EPA Method 360.1	Water	1 x 250 mL HDPE Bottle[3]	Add 2 mL of manganous sulfate solution and then 2 mL of alkaline iodide-azide solution. 10°C – dark	300 mL	Analysis in 4 to 8 hrs[2]
Total Nitrogen as Nitrite + Nitrite (N/N)	E353.2	Water	1 x 500 mL HDPE Bottle	H2SO4 to pH < 2 4° ± 2°C	300mL	28 days
Chlorophyll *a*	E445.0	Water	4 x 1LAmber Boston Round Bottle	Freeze to -20°C	4 L	4 hours to filtration; 25 days to analysis
VOCs	TO-17	Air	Sorbant Tube	Reseal tube and cool to 4°C	1 L @100 mL/min for 10 minutes	28 days
VOCs	TO-15	Air	SUMMA Canister	Maintain approximately 3” vacuum after collection	6 liter @ 2L/min for 2-2.5 min grab sample collection	30 days

Table 4-2
Screening Level and Laboratory Reporting Limits for Water

BP Spill, Gulf Coast

Analyte	Screening Level (µg/L)	Laboratory Reporting Limit (µg/L)
2-Methylnapthalene	72.16	TBD
Acenaphthylene	306.9	TBD
Acenapthene	55.85	TBD
Anthracene	20.73	TBD
Benzo(b)fluoranthene	0.677	TBD
Benzo(g,h,i)perylene	0.439	TBD
Benzo(k)fluoranthene	0.642	TBD
Benzo[a]anthracene	2.227	TBD
Benzo[a]pyrene	0.957	TBD
Dibenz[a,h,]anthracene	0.2825	TBD
Fluorene	39.3	TBD
Fluroanthene	7.109	TBD
Indeno(1,2,3-cd)pyrene	0.275	TBD
Napthalene	193.5	TBD
Phenanthrene	19.13	TBD
Pyrene	10.11	TBD

Table 4-3
Screening Level and Laboratory Reporting Limit for Air (TO-17)

BP Spill, Gulf Coast

Compound	Reporting Limit (nanogram)	Reporting Limit Assuming a 1Liter Sample Collection (µg/m3)	Appropriate MDL for 1 Liter sample (ppb)
Light hydrotreated petroleum distillate 64742-47-8	1,000	1,000	200
2-butoxyethanol	50 (estimated)	50	10
Propylene glycol	500 (estimated)	500	160

Note: Air results will be evaluated against the Hazardous Air Pollutant Screening levels currently in use. For compounds without current screening levels EPA will derive levels based on ATSDR data or other published sources.

Table 4-4
Test Conditions and Measurement Endpoints:
***A. bahia* 96-Hour Acute Toxicity Screen**

Test Species		*Americamysis bahia*
Test Protocol		EPA-821-R-02-012 (EPA 2002)
Test Type / Duration		Static-renewal / 96 hours
Sample storage conditions		4°C, dark, minimum head space
Water Quality Parameters	**Temperature**[1]	20 ± 1°C
	Dissolved Oxygen[1]	≥4.0 mg/L
	Salinity[1]	5-30 ppt ± 10%
	pH[1]	Monitor for pH drift
	Total ammonia[2]	96-Hour NOEC (24.7 mg/L)
	Unionized ammonia[2]	96-Hour NOEC (1.01 mg/L)
Photoperiod/light intensity		16h light, 8h dark (50-100 ft-c)
Test chamber size		500 mL
Test solution volume		250 mL
Renewal of test solution		After 48 hours
Age of test organisms		1-5 days (within 24h range in age)
Treatments		Control, reference, 100% (where applicable)
Replicates/treatment		4
Organisms/replicate		10
Feeding		Approx. 100 *Artemia nauplii* per mysid daily
Control water		Natural seawater; 3µm filtered, UV sterilized
Measurement endpoints		Survival at 24, 48, 72 and 96 hours
Test acceptability		≥ 90% survival in controls
Reference toxicant / duration / endpoint		Copper sulfate / 96-Hour / LC50
Reference toxicant concentrations		Control, 62.5, 125, 250, 500, and 1000 ppb

[1] Measured daily
[2] Measured at beginning and end of test

Table 4-5
Test Conditions and Measurement Endpoints:
***M. beryllina* Acute Toxicity Screen**

Test Species		*Menidia beryllina*
Test Protocol		EPA-821-R-02-012 (EPA 2002)
Test Type / Duration		Static-renewal / 96 hours
Water Quality Parameters	**Temperature**[1]	20 ± 1°C
	Dissolved Oxygen[1]	≥4.0 mg/L
	Salinity[1]	5-32 ppt ± 10%
	pH[1]	Monitor for pH drift
	Total ammonia[2]	96-Hour NOEC (4.53 mg/L)
	Unionized ammonia[2]	96-Hour NOEC (0.3 mg/L)
Photoperiod/light intensity		16h light, 8h dark (50-100 ft-c)
Test chamber size		1000 mL
Test solution volume		500 mL
Renewal of test solution		After 48 hours
Age of test organisms		9-14 days (within 24h range in age)
Treatments		Control, reference, 100% (where applicable)
Replicates/treatment		4
Organisms/replicate		10
Feeding		Approx. 100 *Artemia nauplii* per test organism at 48 hours (2h prior to renewal)
Control water		Natural seawater; 3µm filtered, UV sterilized
Test observations		Survival at 24, 48, 72 and 96 hours
Test acceptability		≥ 90% survival in controls
Reference toxicant / duration / endpoint		Copper sulfate / 96-Hour / LC50
Reference toxicant concentrations		Control, 25, 50, 100, 200, and 400 ppb

[1] Measured daily
[2] Measured at beginning and end of test

Table 4-6
Test Conditions and Measurement Endpoints:
***A. bahia* Chronic Toxicity**

Test Species		*Americamysis bahia*
Test Protocol		EPA-821-R-02-014 (EPA 2002)
Test Type / Duration		Static-renewal / 7 days
Water Quality Parameters	**Temperature**[1]	26 ± 1°C
	Dissolved Oxygen[1]	≥4.0 mg/L
	Salinity[1]	5-32 ppt ± 2 ppt
	pH[1]	Monitor for pH drift
	Total ammonia[2]	96-Hour NOEC (24.7 mg/L)
	Unionized ammonia[2]	96-Hour NOEC (1.01 mg/L)
Photoperiod/light intensity		16h light, 8h dark (50-100 ft-c)
Test chamber size		500 mL
Test solution volume		250 mL
Renewal of test solution		Daily
Age of test organisms		7 days
Treatments		Control, reference, 6.25, 12.5, 25, 50 and 100%
Replicates/treatment		8
Organisms/replicate		5
Feeding		75 *Artemia nauplii* per mysid, twice per day
Control water		Natural seawater; 3µm filtered, UV sterilized
Test salinity		20-30 ppt ± 2 ppt
Endpoints:		Survival (daily); growth (7 days); egg development at test termination if ≥ 50% of females in controls produce eggs
Test acceptability		≥ 80% survival in controls; average dry weight 0.20 mg or greater in controls
Reference toxicant / duration / endpoint		Copper sulfate / 7-Day / LC50; EC50
Reference toxicant concentrations		Control, 62.5, 125, 250, 500, and 1000 ppb

[1] Measured daily
[2] Measured at beginning and end of test

Table 4-7
Test Conditions and Measurement Endpoints:
***M. beryllina* Chronic Toxicity**

Test Species		*Menidia beryllina*
Test Protocol		EPA-821-R-02-014 (EPA 2002)
Test Duration		7 days
Water Quality Parameters	**Temperature[1]**	25 ± 1°C
	Dissolved Oxygen[1]	≥4.0 mg/L
	Salinity[1]	5-32 ppt ± 2 ppt
	pH[1]	Monitor for pH drift
	Total ammonia[2]	96-Hour NOEC (4.53 mg/L)
	Unionized ammonia[2]	96-Hour NOEC (0.3 mg/L)
Photoperiod/light intensity		16h light, 8h dark (50-100 ft-c)
Test chamber size		1000 mL
Test solution volume		500 mL
Renewal of test solution		Daily
Age of test organisms		7-11 days (within 24h range in age)
Treatments		Control, reference, 6.25, 12.5, 25, 50 and 100%
Replicates/treatment		4
Organisms/replicate		10
Feeding		Approx. 1000 *Artemia* nauplii per replicate on days 0-2; 1500 *Artemia* nauplii per replicate on days 3-6.
Control water		Natural seawater; 3µm filtered, UV sterilized
Test observations		Survival (daily); growth after 7 days
Test acceptability		≥ 80% survival in controls; ≥ 0.43 mg average dry weight per surviving control larvae
Reference toxicant / duration / endpoint		Copper sulfate / 7-Day/ LC50; EC50
Reference toxicant concentrations		Control, 25, 50, 100, 200, and 400 ppb

[1] Measured daily
[2] Measured at beginning and end of test

Table 4-8
Test Conditions and Measurement Endpoints:
A. punctulata

Test Species		*Arbacia punctulata*
Test Protocol		ASTM 1563-98 (2004); EPA/600/R-95/136
Test Duration		48 to 96 hours (≥ 70% control development to normal pluteus larvae)
Water Quality Parameters	**Temperature**[1]	20 ± 1°C
	Dissolved Oxygen[1]	≥4.5 mg/L
	Salinity[1]	34 ± 2 ppt
	pH[1]	Monitor for pH drift
	Total ammonia[2]	96-Hour NOEC (N/A)
	Unionized ammonia[2]	96-Hour NOEC (0.09 mg/L)
Photoperiod/light intensity		16h light, 8h darkness (50-100 ft-c)
Test chamber size		30 mL
Test solution volume		10 mL
Renewal of test solution		None
Age of test organisms		Embryos (≤ 4 hours)
Treatments		Control, reference, 6.25, 12.5, 25, 50 and 100%
Replicates/treatment		4
Organisms/replicate		~270 embryos
Feeding		None
Control water		Natural seawater; 0.2µm filtered, UV sterilized
Test acceptability		≥ 70% of embryos normally developed pluteus larvae,
Reference toxicant / duration / endpoint		Copper sulfate / 96-Hour / EC50
Reference toxicant concentrations		Control, 3.75, 7.5, 15, 30, and 60 ppb

[1] Measured daily
[2] Measured at beginning and end of test

4.1.2.4 Collection of Samples for PAH analysis

For each bioassay test conducted, samples will be collected from the 100% water at test initiation (1 sample for all tests initiated concurrently) and at test termination (1 sample from each test conducted) to be subsequently analyzed by GS/MS for PAHs (Method 8270C). Results of this analysis will be used to delineate PAH fractions and concentrations resulting in toxicity and provide a basis for comparison to samples collected in the field.

4.1.2.5 Evaluation Criteria for Ecotoxicity Assessment

If there are no significant differences in the ecotoxicity test results (survival, growth, and reproduction endpoints) between the control and the highest treatments (100% water sample), the evaluation will be a determination of acceptable risk to aquatic life. If toxicity is observed in 100% water sample or its dilutions, then EPA and NOAA will interpret the adverse results of the toxicity tests in conjunction with the benefits of dispersing the oil to inform ongoing determinations of utility of continued application of dispersants. Two repeated rounds of acceptable toxicity tests result (all endpoints) will elevate the biological monitoring to the RRT for potential discontinuation.

4.1.3 Fluorometric Analysis

Continuous measurements of in situ fluorescence will be conducted to identify the concentrations of polycyclic aromatic hydrocarbons, toxic compounds which are also markers for the presence of crude oil. Although measurements of fluorescence do not provide specific concentrations of PAHs in the water column, they will give a qualitative assessment of fluorescence relative to reference readings in order to determine the location of the dispersed oil plume. Two fluorometers (excitation wavelength of 320 nm and emission wavelength of 400-600 nm), or equivalent, shall be towed by boat at 1-m and 2-m depths in order to collect simultaneous measurements of fluorescence at increasingly deeper depths. The units shall be secured to a load bearing weighted tow line in order to maintain near vertical assessments of the water column while under way. The fluorometers will output digital data through RS232 interface cables to a datalogger or field computer onboard the vessel for review by field scientists. Deployment and

operation of the fluorometers will be conducted in accordance with the standard operating procedures provided by the manufacturer.

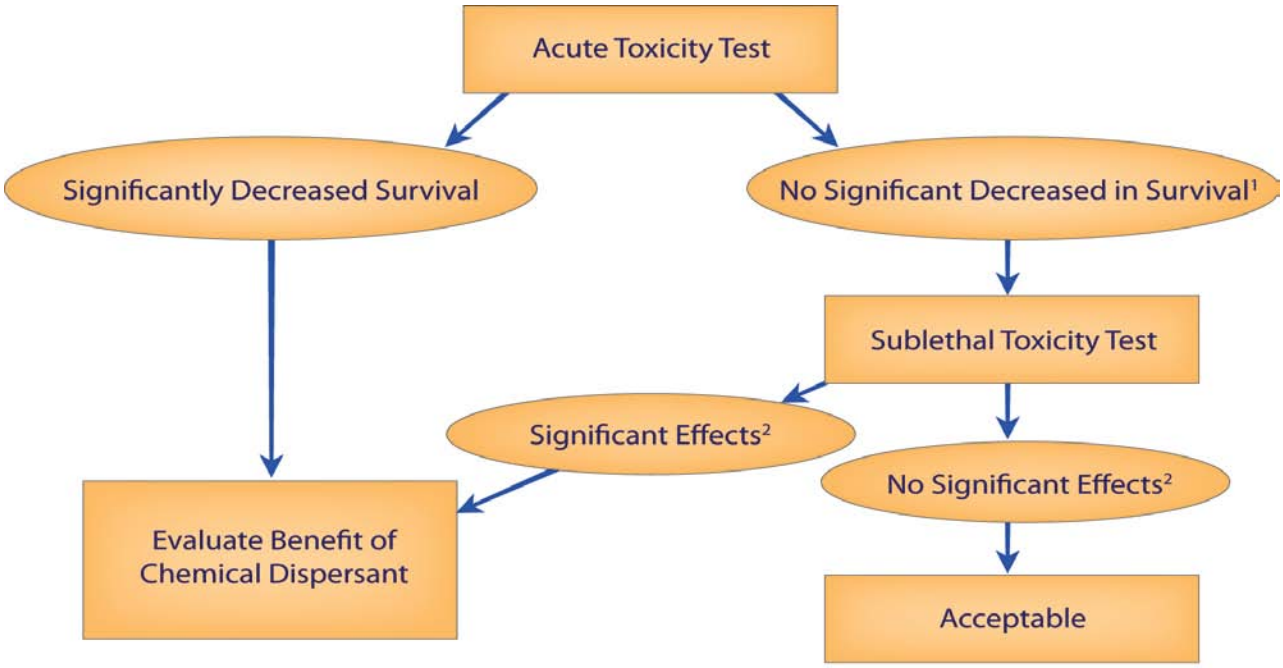
4.2 DATA VALIDATION

EPA will validate the analytical data generated by the laboratory using EPA-approved validation procedures in accordance with the EPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review. A summary of the data validation findings will be presented in Data Validation Summary Reports as part of the final report. EPA will evaluate the following applicable parameters to verify that the analytical data is within acceptable QA/QC tolerances:

- The completeness of the laboratory reports, verifying that required components of the report are present and that the samples indicated on the accompanying chain-of-custody are addressed in the report.
- The calibration and tuning records for the laboratory instruments used for the sample analyses.
- The results of internal standards analyses.
- The results of laboratory blank analyses.
- The results of laboratory control sample (LCS) analyses.
- The results of matrix spike/matrix spike duplicate (MS/MSD) analyses.
- The results of surrogate recovery analyses.
- Compound identification and quantification accuracy.
- Laboratory precision, by reviewing the results for blind field duplicates.

Variances from the QA/QC objectives will be addressed as part of the Data Validation Summary Reports.

Figure 4-1
Toxicity Test



[1]Comparison between test control and 100% seawater sample

[2]Significant decrease in survival, growth, and/or reproduction endpoints in 100, 50, 25, 12.5, or 6.25% seawater sample compared to test control

5. QUALITY ASSURANCE

Quality assurance will be conducted in accordance with EPA protocols. EPA and EPA contractor personnel will be assigned and will monitor work conducted throughout the entire project including reviewing interim report deliverables and field audits. The EPA and EPA contractors will be responsible for QA/QC of the field sampling and monitoring activities. The designated laboratory(s) utilized during the investigation will be responsible for QA/QC related to the analytical work. EPA and EPA contractors will also collect samples to verify that laboratory(s) QA/QC is consistent with the required standards and to validate the laboratory data received.

5.1 SAMPLE CUSTODY PROCEDURES

5.1.1 Chain of Custody (COC)

This section describes the program requirements for sample handling and COC procedures. Samples are considered to be in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group. Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification
- Sample collection date and time
- Any special notations on sample characteristics
- Initials of the person collecting the sample
- Date the sample was sent to the laboratory
- Shipping company and waybill information

Upon filling one cooler with samples and prior to transferring custody, the cooler will be affixed with a custody seal to prevent any tampering of the samples during transport. Any transfer of

custody of the sample or cooler must be documented on the COC. The COC form will be signed by the person transferring custody of the samples. Each custody transfer will also include a copy of the COC for the field sampling team's files. The completed COC form will be placed in a sealable plastic envelope that will be attached to the ice chest containing the listed samples.

Upon receipt at the laboratory, the laboratory receiving personnel will follow their standard login sampling procedures outlined in the laboratory's approved quality assurance program plan. The field team or courier will also be provided a receipt of sample login and a copy of the COC for their records.

5.1.2 Sample Shipment

The samples will be preserved and packaged in coolers with ice according to appropriate sample packing guidelines. In general, the samples will be shipped via overnight carrier to the participating laboratories by either the United Parcel Service (UPS) or Federal Express (Fed Ex). The Department of Transportation (DOT) and International Air Transport Association (IATA) regulations governing environmental and hazardous sample packaging, labeling and sampling will be followed.

Prior to shipping, sample containers will be placed in sealable plastic bags and securely packed with bubble wrap or similar padding inside the cooler with ice. COC forms will be filled out (see Section 3.2.6), and the original signed COC forms will be inserted in a sealable plastic bag and placed inside the cooler. The cooler lids will be securely taped shut, a custody seal applied, and then delivered to shipping company, courier, or directly to the analytical laboratories.

EPA and EPA contractors will prepare and complete chain-of-custody forms using the Scribe Environmental Sampling Data Management System (SCRIBE) for all samples sent to an EPA designated off-site laboratory. The COC procedures are documented and will be made available to all personnel involved with the sampling. A typical COC record will be completed each time a sample or group of samples is prepared for shipment to the laboratory. The record will repeat the information on each sample label and will serve as documentation of handling during shipment. A copy of this record will remain with the shipped samples at all times, and another copy will be retained by the member of the sampling team who originally relinquished

the samples. At the completion of the project, the data manager will export the SCRIBE COC documentation to the Analytical Service Tracking System (ANSETS) database.

Samples relinquished to the participating laboratories will be subject to the following procedures for transfer of custody and shipment:

- Samples will be accompanied by the COC record. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the sample transfer on the record. This custody records document transfer of sample custody from the sampler to another person or to the laboratory.
- Samples will be properly packed for shipment and dispatched to the appropriate laboratory for analysis with separate, signed custody records enclosed in each sample box or cooler. Sample shipping containers will be custody-sealed for shipment to the laboratory. The preferred procedure includes use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal will then be folded over and stuck to seal to ensure that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape.
- If sent by common carrier, a bill of lading or airbill will be used. Bill of lading and airbill receipts will be retained as part of the permanent documentation of sample shipping and transfer.

5.2 PROJECT DOCUMENTATION

Field observations will be recorded legibly and in ink and by entry into field logbooks, Response Manager, or SCRIBE. Response Manager is the Enterprise Data Collection System designed to provide near real-time access to non-analytical data normally collected in logbooks. Response Manager provides a standard data collection interface for modules of data normally collected by EPA field personnel while on-site. These modules fall into two basic categories for Response and Removal. The modules include Emergency Response, Reconnaissance, Facility Assessment, Shipping, Containers, Materials, Calls, HHW, and General/Site Specific data. The system provides users with a standard template for laptop/desktop/tablet PCs that will synchronize to the secure web interface using merge replication technology to provide access to field collected data via on the RRC-EDMS EPA Web Hub. Response Manager also includes a PDA application that provides some of the standard data entry templates from Response Manager to users for field data entry. Response Manager also includes an integrated GPS unit with the secure PDA application, and the coordinates collected in Response Manager are automatically mapped on the

RRC-EDMS interactive mapping site. GIS personnel can then access this data to provide comprehensive site maps for decision-making support.

Response Manager also includes an Analytical Module that is designed to give SCRIBE users the ability to synchronize the SCRIBE field data to the RRC-EDMS Web Hub. This allows analytical data managers and data validators access to data to perform reviews from anywhere with an Internet connection. The Analytical Module is designed to take the analytical data entered into EPA SCRIBE software and make it available for multiple users to access on one site. EPA personnel will utilize SCRIBE for data entry on-site and will upload to the Response Manager Analytical module.

5.2.1 Field Documentation

The following field documentation will be maintained as described below.

Field Logbook

The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. Logbook entries will be signed by the individuals making them. Entries should include, at a minimum, the following:

- Site name and project number.
- Names of personnel on-site.
- Dates and times of all entries.
- Description of all site activities, including site entry and exit times.
- Noteworthy events and discussions.
- Weather conditions.
- Site observations.
- Identification and description of samples and locations.
- Subcontractor information and names of on-site personnel.
- Dates and times of sample collections and chain-of-custody information.
- Records of photographs.
- Calibration results.

Sample Labels

Sample labels will be securely affixed to the sample container. The labels will clearly identify the particular sample and include the following information:

- Site name and project number.
- Date and time the sample was collected.
- Sample preservation method.
- Analysis requested.
- Sampling location.

Chain-of-Custody Record

A chain-of-custody will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept by each individual who has signed it.

Custody Seal

Custody seals demonstrate that a sample container has not been tampered with or opened. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

Photographic Documentation

EPA and EPA contractors will take photographs to document site conditions and activities. Photographs should be taken with either a film camera or digital camera capable of recording the date on the image. Each photograph will be recorded in the logbook and within Response Manager with the location of the photographer, direction the photograph was taken, the subject of the photograph, and its significance (i.e., why the picture was taken). Where appropriate, the photograph location, direction, and subject will also be shown on a site sketch and recorded within Response Manager.

5.2.2 Report Preparation

At the completion of the project, EPA will review and validate laboratory data and prepare a draft report of field activities and analytical results for EPA review. Draft deliverable documents will be uploaded to the EPA TeamLink website for EPA review and comment.

5.2.3 Response Manager

EPA and EPA contractors will use the Response Manager module located on the EPA Web Hub, https://solutions.westonproject.net/epawebhub/, to collect and organize the data collected from project activities. The information to be included encompasses some or all of the following depending on the specific project needs:

- General Module – Site specific data including location and type of site. It also includes an area for key site locations including geo-spatial data associated with the key site locations.
- Emergency Response Module – includes the following sub-modules: Basic Info, HAZMAT, Release, Time Line Log, Incident Zones, Photos, Sensitive Receptors, Evacuations, Source, Cause, and Weather.
- Reconnaissance Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for targeted reconnaissance efforts. Typically the data in this module is associated with ESF-10 deployments and the clean-up of orphaned containers and hazardous debris, but the module can be utilized for any and all reconnaissance activities.
- Facility Assessment Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for assessments of structures. This is typically utilized for EPA regulated program facilities during an ESF-10 deployment of resources. This module can be utilized to track the assessment of any facilities including multiple assessments of the fixed facilities.
- Shipping Module – provides standard templates for creating a cradle-to-grave record of waste shipments from the site until they are recycled or destroyed. This includes the ability to capture manifests and manifest line items and to upload photos/original documents to support the records.
- Container Module – provides standard templates for cataloguing containers including HAZCAT and Layer information in each container. The module also allows for the tracking of which containers are bulked.
- Properties Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for collection of property data including access agreements and assessments of the property and current status of property regarding the site removal action.
- Materials Module – provides standard templates for tracking materials that are brought on-site or that are removed from the site.
- Daily Reports – provides standard templates for tracking daily site activities, daily site personnel, and daily site notes for reporting back to the EPA in a POLREP or SITREP.

- HHW Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for tracking the amount of HHW collected at individual collection stations by HHW type.
- Data Files – data files can be uploaded in the photo-module section and be associated with individual records or with the site in general. The meta data associated with that data file can be filled in using the photo log fields.

The data stored in the Response Manager database can be viewed and edited by any individual with access rights to those functions. At anytime deemed necessary, POLREP and/or SITREPs can be generated by exporting the data out of Response Manager into Microsoft Excel/Word. The database is stored on a secure server and backed up regularly.

6. REFERENCES

USEPA 2002. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. EPA-821-R-02-012. USEPA Office of Water. October.

USEPA 2002. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. EPA-821-R-02-014. USEPA Office of Water. October.

USEPA 1995. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*. EPA/600/R-95/136. USEPA Office of Research and Development. August.

American Society for Testing and Materials. 2009. E 1563-98 (Reapproved 2004) *Standard Guide for Conducting Static Acute Toxicity Tests with Echinoid Embryos*. In Annual Book of Standards, Vol. 11.06. West Conshohocken, PA.